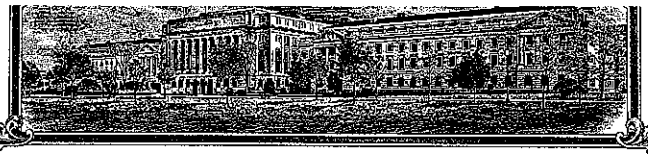
No. 9800368



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

South Dakota Agricultural Experiment Station

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEAT, COMMON

'Crimson'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this twenty-fourth day of April, in the year of our Lord two thousand one.

Attest:

Alan R. Port

Acting Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
South Dakota Agricultural Experiment Station

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME
SD89153

3. VARIETY NAME
Crimson

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
South Dakota State University
Ag Hall 129
Brookings, SD 57007

5. TELEPHONE *(Include area code)*
605-688-4149

6. FAX *(Include area code)*
605-688-6065

FOR OFFICIAL USE ONLY

PVPO NUMBER
9800368

FILING DATE
8-27-98

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Agricultural Experiment Station

8. IF INCORPORATED, GIVE STATE OF INCORPORATION
N/A

9. DATE OF INCORPORATION
N/A

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*

Dr. Kevin Kephart, Director
SD Ag. Exp. Station, Box 2207
South Dakota State University
Brookings, SD 57007

Dr. Amir Ibrahim, W. Wheat Breeder
Plant Science Department
NPB 244B, Box 2140-C, SDSU
Brookings, SD 57007

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 2450.00
DATE 8-27-98

CERTIFICATION FEE:
$ 320
DATE 3-19-01

11. TELEPHONE *(Include area code)*
(605) 688-4453

12. FAX *(Include area code)*
(605) 688-4452

13. E-MAIL
Amir_Ibrahim@sdstate.edu

14. CROP KIND *(Common Name)*
Hard Red Winter Wheat

18. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)

- a. [X] Exhibit A. Origin and Breeding History of the Variety
- b. [X] Exhibit B. Statement of Distinctness
- c. [X] Exhibit C. Objective Description of Variety
- d. [X] Exhibit D. Additional Description of the Variety *(Optional)*
- e. [X] Exhibit E. Statement of the Basis of the Owner's Ownership
- f. [X] Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
- g. [X] Filing and Examination Fee ($2,705), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

19. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *See Section 83(a) of the Plant Variety Protection Act)*
[X] YES *(If "yes", answer items 20 and 21 below)* [ ] NO *(If "no," go to item 22)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES? [ ] YES [X] NO
IF YES, WHICH CLASSES? [ ] FOUNDATION [ ] REGISTERED [ ] CERTIFIED

21. DOES THE OWNER SPECIFY THAT THE CLASSES BE LIMITED AS TO NUMBER OF GENERATIONS? [ ] YES [X] NO
IF YES, SPECIFY THE NUMBER 1, 2, 3, *etc.* [ ] FOUNDATION [ ] REGISTERED [ ] CERTIFIED

(If additional explanation is necessary, please use the space indicated on the reverse.)

22. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
[X] YES U.S.A. Sept 1, 1997 [ ] NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

23. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
[ ] YES [X] NO
IF YES, GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

4. The owners declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

GNATURE OF OWNER
Kevin O. Kephart

SIGNATURE OF OWNER

AME *(Please print or type)*
Dr. Kevin Kephart

NAME *(Please print or type)*

APACITY OR TITLE
Director, SD Ag. Exp. Station

DATE
02/8/01

CAPACITY OR TITLE

DATE

-470 (2-99) designed by the Plant Variety Protection Office with WordPerfect 6.0a. Replaces STD-470 (6-98) which is obsolete. *(See reverse for instructions and information collection burden statement)*

EXHIBIT A
Crimson (SD89153)
Origin and Breeding History of the Variety

Crimson was selected as an $F_{5:6}$ line from the cross 'TAM-105'/'Winoka' made in 1983. The cross (coded X83229) was advanced to the F_5 generation with a bulk breeding procedure. The F_1 plants were grown in the greenhouse in Brookings, South Dakota in 1984 and advanced to the F_2 generation without deliberate selection. The F_2 populations were grown in Brookings and Highmore, South Dakota and selections were made based on grain yield, test weight, pedigree, disease resistance, maturity, plant height, and resistance to lodging. The F_3 generation was grown in Brookings and Dakota Lakes Research Farm near Pierre, South Dakota, and about 100 heads were picked from the most promising populations using the same traits with which the F_2 bulks were advanced. The head rows were planted in Dakota Lakes Research Farm near Pierre, South Dakota in 1988 and selection among these rows was done based on maturity, pedigree, and resistance to lodging and diseases. Crimson was identified as experimental line SD89153 in 1989. Crimson was then grown in the early yield trial in Brookings, Selby, and Winner, South Dakota. Selection at this generation was based on yield, test weight, disease resistance, and quality characteristics. The most promising lines were advanced to the preliminary yield trial (5 locations) followed by the advanced yield trial the following year (6 locations).

Crimson (SD89153) has been tested in advanced yield trials of the South Dakota Winter Wheat Breeding Program since 1992, the South Dakota Crops Performance Testing (CPT) Variety Trial since 1994 and the Northern Regional Performance Nursery (NRPN) from 1994-1996. Crimson was also tested in the Wheat Quality Council Small-Scale Testing program in 1996 and 1997. Breeder seed, produced in 1995-1996, originated from a purification program in 1995-1996 (F_{11} generation) to remove off-types by roguing. Foundation seed was produced in 1996-1997.

Crimson has been uniform and stable for all morphological characters (such as maturity and plant height) during the past four generations of selfing and increase. A tall (10 cm taller) bronze-chaffed variant was identified in the breeder seed at a frequency of approximately 0.06%. A tall (10 cm taller) white-chaffed variant was identified in breeder seed at a frequency of 0.05%. A white-chaffed variant of similar plant height was identified in breeder seed at a frequency of 0.2%. Up to 0.5% variant plants may be encountered in subsequent generations.

9800368

EXHIBIT B
Crimson (SD89153)
Statement of Distinctness

Crimson is most similar to the hard red winter wheat cultivar 'Rose', but differs in the following characteristics:

1) **Mixograph Mix Time**: Crimson has a shorter (2.7 ± 0.3 min; n=4) mixograph mix time than Rose (3.3 ± 0.2 min; n=4).
2) **Grain Yield**: Crimson has 2.1 LB/ACRE more grain yield than Rose, when recorded directly from the combine (Table 1).
3) **Test Weight:** Crimson has 0.6 LB/Bu more test weight than Rose, when recorded directly from the combine (Table 1).
4) **Polyacrylamide Gel Electrophoresis (PAGE)**: Polyacrylamide Gel Electrophoresis shows that Crimson and Rose have distinctly different seed storage protein banding patterns. (Photograph 1). The arrows on the photograph point to bands that are present in Rose but missing in Crimson and vice versa.

The PVP office ran a database search to determine the novelty of Crimson and found similarities with the variety 'McGuire'. Polyacrylamide Gel Electrophoresis shows that Crimson and McGuire have distinctly different seed storage protein banding patterns. (Photograph 2). The arrows on the photograph point to bands that are present in Crimson but missing in McGuire and vice versa. A urea Polyacrylamide Gel Electrophoresis also shows that Crimson and McGuire have distinctly different seed storage protein banding patterns (Photograph 3). The arrows on the photograph point to bands that are present in Crimson but missing in McGuire and vice versa

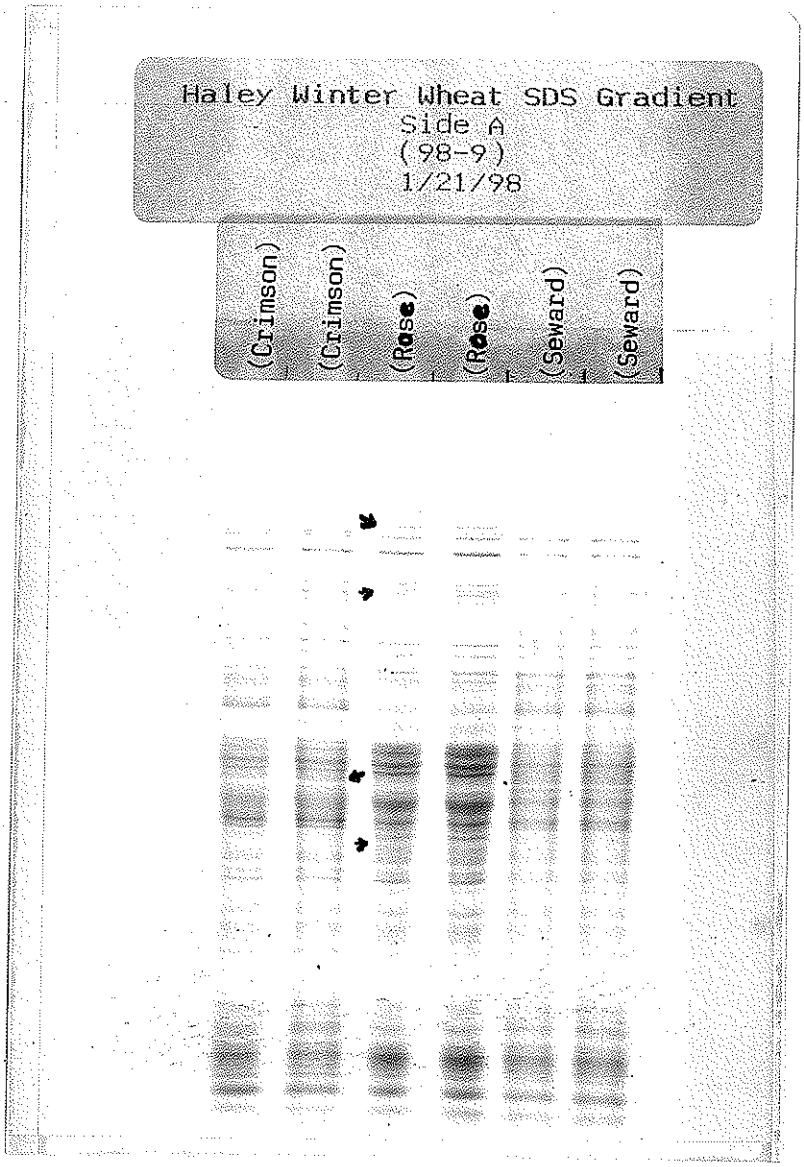
Davis, B. 1964. Disc electrophoresis. II. Method and application to human serum protein. Ann. New York Acad. Sci. 121:404-427.

Table 1. South Dakota State University, Winter Wheat Breeding Trials Combined Over Locations and Years.

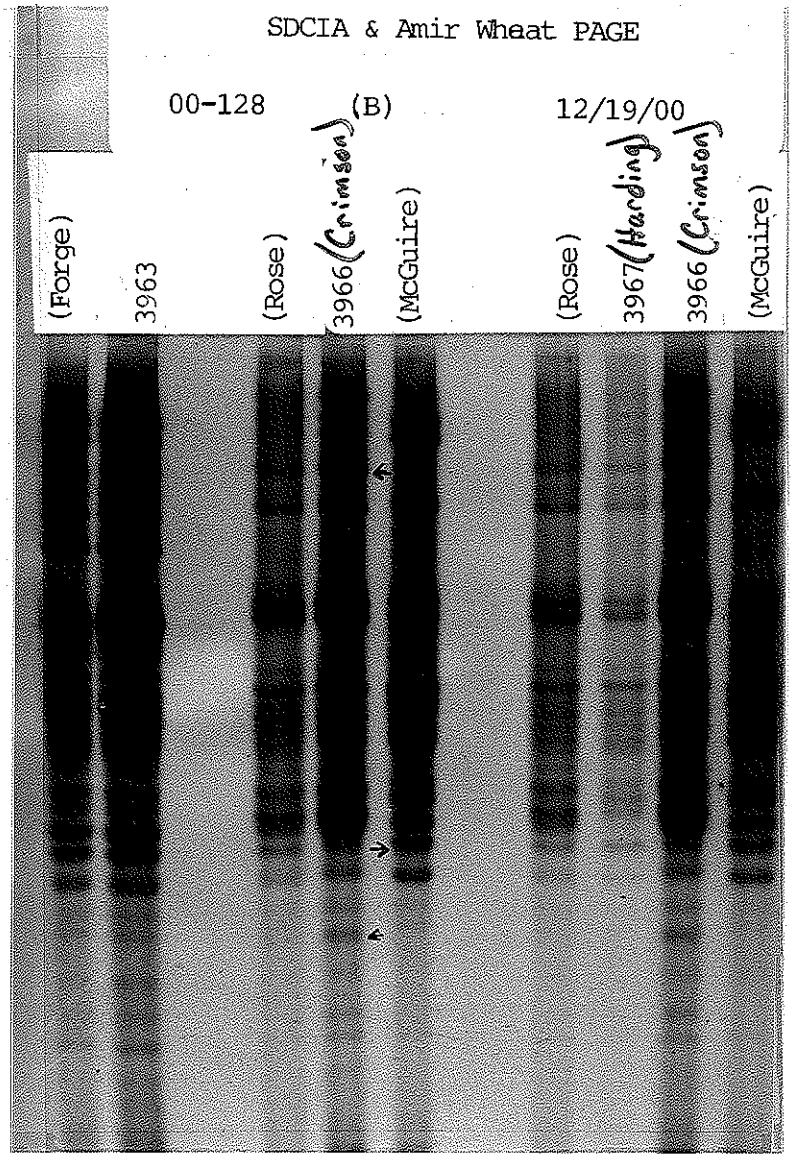
	Grain Yield (bu/a)					Test Weight (lb/bu)					Heading (days)					Plant Height (inches)				
	94 (12)	95 (11)	96 (8)	97 (5)	94-97 (36)	94 (12)	95 (11)	96 (8)	97 (5)	94-97 (36)	94 (2)	95 (5)	96 (1)	97 (3)	94-97 (11)	94 (8)	95 (11)	96 (8)	97 (4)	94-97 (31)
Crimson	43.5	47.3	56.4	56.0	49.3	61.9	61.8	61.7	60.7	61.7	160.0	166.1	165.3	165.6	164.8	27.7	36.1	34.3	35.6	33.4
Rose	41.1	45.3	55.9	52.1	47.2	61.0	61.3	61.5	60.5	61.1	160.1	166.3	166.0	166.1	165.1	28.2	36.1	35.2	35.1	33.7
Seward	43.5	44.8	55.2	49.0	47.3	59.7	58.9	59.2	57.4	59.0	161.9	167.4	171.0	169.8	167.4	31.6	38.8	37.2	39.6	36.6
CV%	17.4	17.5	12.6	15.0	16.6	2.8	2.3	2.8	2.0	2.6	1.0	0.7	1.4	1.1	1.0	9.4	6.7	6.4	6.1	8.5
LSD (.05)	2.3	3.0	2.8	4.2	1.6	0.6	0.5	0.7	0.6	0.3	1.3	0.6	2.1	1.2	0.6	1.1	0.8	0.9	1.2	0.6

N.B.: Figures in parentheses indicate the number of locations that data was collected from.

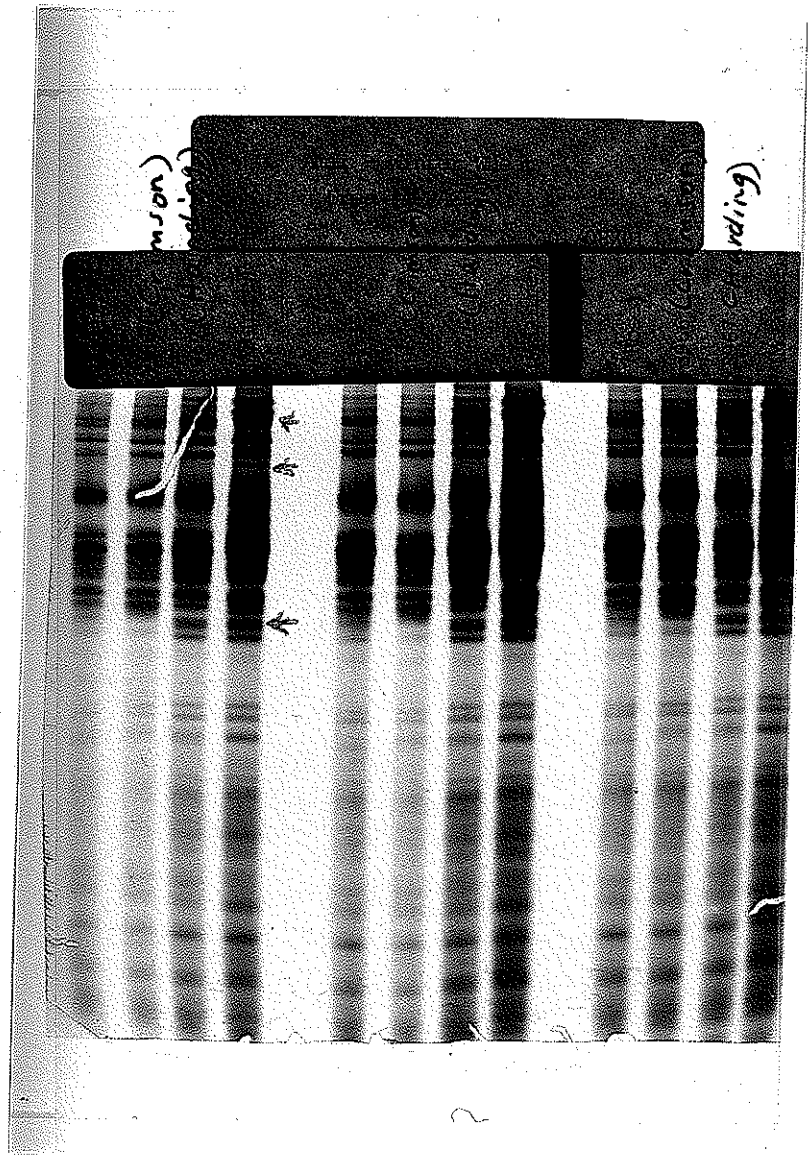
Photograph 1. Acid polyacrylamide gel electrophoresis (PAGE) of hard red winter wheat cultivars Crimson, Rose, and Seward. The Acid PAGE was conducted by Dr. Brent Turnipseed, Seed Testing Lab, Plant Science Department, South Dakota State University.



Photograph 2. Acid polyacrylamide gel electrophoresis (PAGE) of hard red winter wheat cultivars Crimson, McGuire, Rose, and Harding. The Acid PAGE was conducted by Dr. Brent Turnipseed, Seed Testing Lab, Plant Science Department, South Dakota State University.



Photograph 3. Urea polyacrylamide gel electrophoresis (PAGE) of hard red winter wheat cultivars Crimson, McGuire, Rose, and Harding. The Urea PAGE was conducted by Ms. Mary Thompson, Seed Testing Lab, Plant Science Department, South Dakota State University.



REPRODUCE LOCALLY. Include form number and date on all reproductions.

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

EXHIBIT C
(Wheat)

OBJECTIVE DESCRIPTION OF VARIETY
WHEAT (*Triticum* spp.)

NAME OF APPLICANT(S)
South Dakota Agricultural Experiment Station

ADDRESS *(Street and No. or RD No., City, State, and Zip Code)*
South Dakota State University
Ag Hall 129
Brookings, SD 57007

FOR OFFICIAL USE ONLY

PVPO NUMBER
9800368

VARIETY NAME
Crimson

TEMPORARY OR EXPERIMENTAL DESIGNATION
SD89153

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g. [0][9] or [0][9]) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used:
Please answer all questions for your variety; lack of response may delay progress of your application.

1. KIND:

[1] 1=Common 2=Durum 3=Club 4=Other (SPECIFY) : _____

2. VERNALIZATION:

[2] 1=Spring 2=Winter 3=Other (SPECIFY) : _____

3. COLEOPTILE ANTHOCYANIN:

[1] 1=Absent 2=Present

4. JUVENILE PLANT GROWTH:

[1] 1=Prostrate 2=Semi-erect 3=Erect

5. PLANT COLOR (boot stage):

[1] 1 = Yellow-Green 2 = Green 3 = Blue-Green

6. FLAG LEAF (boot stage):

[1] 1 = Erect 2 = Recurved [2] 1 = Not Twisted 2 = Twisted

7. EAR EMERGENCE:

[0][2] Number of Days Earlier Than Roughrider *

[0][3] Number of Days Later Than Nekota *

8. ANTHER COLOR:

[1] 1 = Yellow 2 = Purple

9. PLANT HEIGHT (from soil to top of head, excluding awns):

[1][2] cm Taller Than Nekota *

[0][5] cm Shorter Than Roughrider *

* Relative to a PVPO-Approved Commercial Variety Grown in the Same Trial

10. STEM:

A. ANTHOCYANIN

[1] 1= Absent 2=Present

B. WAXY BLOOM

[2] 1=Absent 2=Present

C. HAIRINESS (last internode of rachis)

[1] 1=Absent 2=Present

D. INTERNODE (SPECIFY NUMBER) 5

[1] 1= Hollow 2=Semi-solid 3=Solid

E. PEDUNCLE

[2] 1=Absent 2=Present

[13] cm Length

11. HEAD (at Maturity):

A. DENSITY

[2] 1=Lax 2=Middense 3= Dense

B. SHAPE

[1] 1 = Tapering 2= Strap 3 = Clavate 4 = Other (SPECIFY):

C. CURVATURE

[2] 1 = Erect 2 = Inclined 3 = Recurved

D. AWNEDNESS

[4] 1 = Awnless 2 = Apically Awnletted 3 = Awnletted 4 = Awned

12. GLUMES (at Maturity):

A. COLOR

[3] 1 = White 2 = Tan 3 = Other (SPECIFY) : Bronze

B. SHOULDER

[4] 1 = Wanting 2 = Oblique 3 = Rounded 4 = Square 5 = Elevated 6 = Apiculate

C. BEAK

[3] 1 = Obtuse 2 = Acute 3 =Acuminate

D. LENGTH

[2] 1 = Short (ca. 7mm) 2 = Medium (ca. 8mm) 3 = Long (ca. 9mm)

12. GLUMES (at Maturity) *Continued*:

E. WIDTH

[1] 1 = Narrow (ca. 3mm) 2 = Medium (ca. 3.5mm) 3 = Wide (ca. 4mm)

13. SEED:

A. SHAPE

[3] 1 = Ovate 2 = Oval 3 = Elliptical

B. CHEEK

[2] 1=Rounded 2=Angular

C. BRUSH

[2] 1=Short 2=Medium 3=Long

[1] 1 = Not Collared 2 = Collared

D. CREASE

[1] 1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

[1] 1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

E. Color

[3] 1=White 2= Amber 3= Red
4= OTHER (Specify)

G. PHENOL REACTION *(see instructions)*:

[ ] 1 = Ivory 2 = Fawn
3 = Light Brown 4 = Dark Brown
5 = Black

F. TEXTURE

[1] 1=Hard 2=Soft

14. DISEASE: (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED

[3]	Stem Rust *(Puccinia graminis* f. sp. *tritici)*	[1]	Leaf Rust *(Puccinia recondita* f. sp. *tritici)*
[0]	Stripe Rust *(Puccinia striiformis)*	[0]	Loose Smut *(Ustilago tritici)*
[2]	Tan Spot *(Pyrenophora tritici-repentis)*	[0]	Flag Smut *(Urocystis agropyri)*
[0]	Halo Spot *(Selenophoma donacis)*	[0]	Common Bunt *(Tilletia tritici* or *T. laevis)*
[0]	*Septoria nodorum* (Glume Blotch)	[0]	Dwarf Bunt *(Tilletia controversa)*
[0]	*Septoria avenae* (Speckled Leaf Disease)	[0]	Karnal Bunt *(Tilletia indica)*
[1]	*Septoria tritici* (Speckled Leaf Blotch)	[0]	Powdery Mildew *(Erysiphe graminis* f. sp. *tritici)*
[3]	Scab (*Fusarium* spp.)	[0]	"Snow Molds"

14. Disease *(Continued)* (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED

[0]	"Black Point" (Kernel Smudge)	[4]	Common Root Rot *(Fusarium, Cochliobolus* and *Bipolaris* spp.*)*
[0]	Barley Yellow Dwarf Virus (BYDV)	[0]	Rhizoctonia Root Rot *(Rhizoctonia solani)*
[0]	Soilborne Mosaic Virus (SBMV)	[0]	Black Chaff *(Xanthomonas campestris* pv. *translucens)*
[0]	Wheat Yellow (Spindle Streak) Mosaic Virus	[0]	Bacterial Leaf Blight *(Pseudomonas syringae* pv. *syringae)*
[0]	Wheat Streak Mosaic Virus (WSMV)	[ ]	Other (SPECIFY)
[ ]	Other (SPECIFY)	[ ]	Other (SPECIFY)
[ ]	Other (SPECIFY)	[ ]	Other (SPECIFY)
[ ]	Other (SPECIFY)	[ ]	Other (SPECIFY)

15. INSECT: (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE SPECIFY BIOTYPE (where needed)

[1]	Hessian Fly *(Mayetiola destructor)*	[ ]	Other (SPECIFY)
[0]	Stem Sawfly *(Cephus* spp.)	[ ]	Other (SPECIFY)
[0]	Cereal Leaf Beetle *(Oulema melanopa)*	[ ]	Other (SPECIFY)
[0]	Russian Aphid *(Diuraphis noxia*	[ ]	Other (SPECIFY)
[0]	Greenbug *(Schizaphis graminum)*	[ ]	Other (SPECIFY)
[0]	Aphids	[ ]	Other (SPECIFY)

16. ADDITIONAL INFORMATION ON ANY ITEM ABOVE, OR GENERAL COMMENTS

Exhibit D
Crimson (SD89153)
Additional Description of the Variety

The following additional descriptive information is presented:

1) Release notice of Crimson.
2) Table 1: Yield, test weight, heading, and plant height data of Crimson in the South Dakota Crops Performance Testing (CPT) variety trial.
3) Table 2: Yield performance data of Crimson in the South Dakota Crops Performance Testing (CPT) variety trial at individual locations.
4) Table 3. Test weight data of Crimson in the South Dakota Crops Performance Testing (CPT) variety trial.
5) Table 4: Agronomic and protein data of Crimson in the South Dakota Crops Performance Testing (CPT) variety trial.
6) Table 5: Milling and baking data of Crimson in the South Dakota Crops Performance Testing.

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY
PLANT SCIENCE DEPARTMENT

Release of CRIMSON Hard Red Winter Wheat

'Crimson' hard red winter wheat was developed by the South Dakota Agricultural Experiment Station and released to seed producers in the fall of 1997. Crimson is an awned, red-glumed, medium-late maturity, standard height hard red winter wheat with good end-use quality characteristics and superior yield performance in its maturity range. The name Crimson was chosen to highlight its red chaff color, a trait in South Dakota most commonly associated with 'Rose' winter wheat.

Crimson was selected (as an F_5-derived line in the F_6 generation) from the cross 'TAM-105'/'Winoka', made in 1983 by Dr. Jeffrey Gellner. Current breeder seed originated from a purification program in 1995-1996 to remove off-types by roguing; up to 1% white-chaffed variants have been identified in breeder-seed production fields. Crimson was identified (as experimental line SD89153) in 1989 and has been tested in the South Dakota Crops Performance Testing (CPT) Variety Trial since 1994 and the Northern Regional Performance Nursery from 1994-1996. In four years of statewide testing in the South Dakota CPT (1994-1997; 32 environments), Crimson (52 bu/a) was higher yielding than available varieties in its maturity range, including Rose (50 bu/a), Seward (49 bu/a), and Roughrider (46 bu/a). Over these same testing environments, Crimson (61.6 lb/bu) exhibited very high and stable test weight characteristics with higher test weight than any other entry tested, including Rose (61.2 lb/bu), Roughrider (60.7 lb/bu), Arapahoe (59.5 lb/bu), and Seward (58.8 lb/bu).

In addition to its high test weight, Crimson has above-average end-use quality characteristics. Composite milling and baking data (provided by the USDA-ARS Hard Winter Wheat Quality Laboratory, Manhattan, KS) from the Northern Regional Performance Nursery (1994-1996) and the South Dakota Advanced Yield Trial (1994-1996) identified Crimson as a wheat with medium-sized kernels with average kernel weight, average flour ash and flour extraction, and high kernel hardness scores. Baking tests from these nurseries identified Crimson as a wheat with high flour protein, high water absorption with average mixing time, average mixing tolerance, and good loaf volume. Crumb grain characteristics from experimental and commercial baking tests have been rated as good.

In South Dakota, Crimson is a medium-late maturity wheat, heading 5 days earlier than Seward, 1 days earlier than Roughrider, similar to Rose, 1 day later than Arapahoe, and 4 days later than Nekota. Plant height of Crimson is medium-tall, 3 inches shorter than Seward, 2 inches shorter than Roughrider, similar to Rose, 2 inches taller than Arapahoe, and 5 inches taller than Nekota. Crimson is moderately resistant to prevalent races of the stem rust pathogen (data provided by USDA-ARS Cereal Rust Laboratory, St. Paul, MN and the South Dakota State University Small Grains Pathology Program), and is susceptible to leaf rust. Crimson is resistant in greenhouse seedling screening tests with South Dakota isolates of the *Septoria* leaf blotch pathogen and has shown good leaf spotting scores in field nurseries. Greenhouse seedlings screening with South Dakota isolates of wheat streak mosaic virus suggest a moderate level of resistance. Crimson is susceptible to the Great Plains Biotype of Hessian Fly (data provided by USDA-ARS Plant Science and Entomology Research Unit, Manhattan, KS). The coleoptile length of SD89153 is very long (98% of Scout 66) and the straw strength is good (slightly better than Rose). Available data suggest that the winterhardiness of Crimson is good.

The South Dakota Foundation Seed Division (Plant Science Department, South Dakota State University, Brookings, SD 57007) had foundation seed of Crimson available to qualified seed producers for planting in fall 1997. The seed classes will be breeder, foundation, registered, and certified. Crimson will be submitted for registration and plant variety protection under P.L. 910577 with the certification option.

Table 1. South Dakota State University, Winter Wheat Breeding Trials Combined over Locations and Years.

	Grain Yield (bu/a)					Test Weight (lb/bu)					Heading (days)					Plant Height (inches)				
	1994	1995	1996	1997	94-97	1994	1995	1996	1997	94-97	1994	1995	1996	1997	94-97	1994	1995	1996	1997	94-97
	(12)	(11)	(8)	(5)	(36)	(12)	(11)	(8)	(5)	(36)	(2)	(5)	(1)	(3)	(11)	(8)	(11)	(8)	(4)	(31)
Alliance	41.3	55.5	54.0	56.2	50.5	59.6	59.7	59.2	56.9	59.2	157.0	162.5	160.5	163.6	161.6	25.0	32.8	29.8	31.0	29.8
Arapahoe	42.0	50.3	58.8	61.9	51.0	60.1	59.7	59.9	58.3	59.7	157.6	164.4	164.8	165.1	163.4	26.6	33.8	32.7	33.6	31.6
Crimson	**43.5**	**47.3**	**56.4**	**56.0**	**49.3**	**61.9**	**61.8**	**61.7**	**60.7**	**61.7**	**160.0**	**166.1**	**165.3**	**165.6**	**164.8**	**27.7**	**36.1**	**34.3**	**35.6**	**33.4**
Dawn	39.0	46.9	50.0	50.2	45.4	60.6	60.2	59.7	59.1	60.1	157.5	164.5	164.3	164.3	163.1	26.0	32.7	31.0	32.4	30.5
Nekota		53.8	54.4	59.8	55.3		61.0	60.8	59.1	60.5		163.0	162.3	163.1	162.9		32.0	29.0	30.9	30.8
Niobrara		51.7	54.1	52.4	52.6		59.2	58.3	57.1	58.5		163.2	163.8	165.6	164.1		34.2	32.0	33.6	33.3
Rose	**41.1**	**45.3**	**55.9**	**52.1**	**47.2**	**61.0**	**61.3**	**61.5**	**60.5**	**61.1**	**160.1**	**166.3**	**166.0**	**166.1**	**165.1**	**28.2**	**36.1**	**35.2**	**35.1**	**33.7**
Roughrider	36.5	35.8	57.3	50.7	42.9	90.6	60.4	61.8	59.4	60.6	162.1	167.5	167.0	168.3	166.7	31.3	38.2	39.1	40.4	37.0
Scout66	37.7	42.6	49.7	47.8	43.2	61.3	61.0	60.8	59.7	60.9	155.1	163.6	163.3	163.9	162.1	29.0	38.1	36.0	38.4	35.3
Seward	**43.5**	**44.8**	**55.2**	**49.0**	**47.3**	**59.7**	**58.9**	**59.2**	**57.4**	**59.0**	**161.9**	**167.4**	**171.0**	**169.8**	**167.4**	**31.6**	**38.8**	**37.2**	**39.6**	**36.6**
Siouxland	37.0	47.4	57.6	55.6	47.4	59.9	59.6	60.4	58.7	59.8	157.1	165.1	163.8	164.5	163.4	28.7	37.3	34.9	37.3	34.5
TAM 107	37.4	55.1	47.0	50.9	46.8	58.9	59.8	58.8	56.6	58.8	152.8	162.1	160.0	161.8	160.1	23.0	31.7	27.2	28.5	27.9
Tandem	42.7	48.3	57.7	52.6	49.1	61.4	61.1	61.1	60.1	61.1	158.0	164.8	164.5	165.0	163.6	26.8	34.7	34.3	35.8	32.7
Vista	40.9	50.6	48.4	57.5	47.9	59.7	59.8	58.7	58.2	59.3	156.9	163.4	162.3	164.2	162.3	23.4	30.6	27.8	29.2	27.8
CV %	17.4	17.5	12.6	15.0	16.6	2.8	2.3	2.8	2.0	2.6	1.0	0.7	1.4	1.1	1.0	9.4	6.7	6.4	6.1	8.5
LSD (.05)	2.3	3.0	2.8	4.2	1.6	0.6	0.5	0.7	0.6	0.3	1.3	0.6	2.1	1.2	0.6	1.1	0.8	0.9	1.2	0.6

Grain Yield Averages (4 Year) - Various Locations

ID (YEARS)	Selby (3)	Wall (2)	Hayes (3)	Bison (3)	Platte (2)	Winner (4)	DLakes (2)	Martin (3)	Oelrichs (3)	Brookings (2)	Watertown (2)	94-97 AVG
Arapahoe	75	51	46	52	51	44	40	57	62	55	61	54
Nekota	77	49	44	52	57	43	42	53	60	57	53	54
Alliance	74	53	46	57	50	44	36	55	62	52	52	53
SD89153	71	48	45	52	56	41	41	55	57	48	56	52
SD89119	76	53	50	54	53	39	35	51	58	50	53	52
Niobrara	73	48	47	52	50	43	38	56	58	49	49	51
Vista	73	51	43	51	47	39	45	49	59	50	55	50
Siouxland	74	41	46	50	49	42	35	47	62	46	47	50
Rose	72	45	40	56	54	35	38	57	55	47	50	50
Seward	75	50	45	55	50	35	35	54	52	48	52	49
TAM 107	67	52	45	47	53	44	35	47	56	45	45	49
Dawn	70	47	40	54	49	36	35	49	53	50	50	48
Roughrider	66	39	41	51	46	32	36	51	52	43	41	46
Scout 66	64	39	44	51	45	34	39	49	53	36	44	46

TABLE 2

TABLE 3

9800368

Test Weight Averages, 1993-1997

ID	(LOCS)	1993 (14)	1994 (9)	1995 (10)	1996 (8)	1997 (5)	94-97 AVG (32)	93-97 AVG (46)
SD89153			62.4	61.8	61.7	60.6	61.6	61.6
Rose		59.1	61.7	61.3	61.4	60.5	61.2	60.8
SD89119		59.3	61.9	61.1	61.0	60.0	61.0	60.7
Roughrider		59.4	61.2	60.4	61.6	59.4	60.7	60.4
Nekota		60.0	61.2	61.0	60.5	59.1	60.4	60.3
Scout 66		58.0	61.6	61.0	60.5	59.7	60.7	60.2
Dawn		58.3	61.2	60.2	59.8	59.1	60.1	59.7
Arapahoe		58.0	60.4	59.7	59.6	58.3	59.5	59.2
Siouxland		56.9	60.4	59.6	60.2	58.7	59.7	59.2
Vista		57.8	60.3	59.8	58.6	58.2	59.2	58.9
Seward		58.4	59.7	58.9	59.2	57.4	58.8	58.7
Alliance		57.6	59.8	59.7	58.9	56.9	58.8	58.6
Niobrara			59.4	59.2	58.4	57.1	58.5	58.5
TAM 107		57.2	59.9	59.7	58.6	56.6	58.7	58.4

TABLE 4

Heading, plant height, lodging, coleoptile length, leaf spot score, and protein data for selected entries in the South Dakota Crops Performance Testing (CPT) Variety Trial.

Name	Heading (days)	Height (inches)	Lodging (score)	Coleoptile (% Scout66)	Leaf Spot (score)	Protein 1993	Protein 1994	Protein 1995	Protein 1996	Protein Average
Seward	171	42	2.5	86	3.3	12.0	12.0	11.5	12.5	12.0
Roughrider	167	41	5.3	106	1.5	12.5	13.4	13.0	13.8	13.2
Rose	166	39	3.3	103	1.8	12.6	13.0	12.2	13.6	12.9
SD89153	165	39	3.0	98	1.3	----	13.4	12.5	13.6	13.2
SD89119	165	38	5.0	94	2.8	12.5	13.2	12.6	14.3	13.2
Arapahoe	165	37	5.5	69	3.8	11.9	12.9	12.0	12.6	12.4
Siouxland	164	40	2.5	76	2.5	11.5	13.0	12.4	13.3	12.6
Nekota	162	34	1.8	74	2.5	12.2	12.8	12.4	13.2	12.7
Alliance	161	34	3.5	64	4.5	12.0	12.0	10.8	11.7	11.6
TAM 107	160	31	1.3	80	4.0	11.7	12.6	11.5	12.8	12.2

Table 5. Quality parameters of selected lines grown in South Dakota environments and tested at the Hard Winter Wheat Quality Laboratory, USDA/ARS, Manhattan, KS.

	1995-1997							1995							1996							1997						
ID	KW	FY	ASH	MS	PRO	ABS	LV	KW	FY	ASH	MS	PRO	ABS	LV	KW	FY	ASH	MS	PRO	ABS	LV	KW	FY	ASH	MS	PRO	ABS	LV
Alliance	28.5	70.4	0.41	85	10.8	66.9	840	28.8	74.2	0.48	84	11.4	69.3	850	28.9	67.5	0.39	87	10.3	66.3	818	27.9	69.4	0.37	85	10.7	65.1	853
Arapahoe	27.9	69.9	0.48	80	11.8	66.8	854	26.9	74.2	0.55	78	12.8	70.1	875	27.9	65.3	0.49	76	11.3	65.9	818	28.9	70.1	0.41	86	11.4	64.4	868
Crimson	28.2	70.2	0.46	86	12.2	70.2	896	28.5	75.1	0.54	85	13.5	71.6	875	27.9	65.4	0.43	82	11.1	71.2	873	28.3	70.1	0.40	90	12.0	67.8	940
Rose	27.2	70.3	0.46	86	12.3	71.1	949	25.2	73.2	0.54	79	13.0	73.2	1020	27.8	68.1	0.45	90	11.8	68.8	883	28.5	69.5	0.40	90	12.2	71.2	943
Roughrider	29.1	71.2	0.55	78	12.6	69.2	939	26.6	76.0	0.63	76	13.3	71.8	935	29.5	67.5	0.54	74	11.8	69.6	888	31.3	70.1	0.47	86	12.6	66.3	993
Scout66	34.3	70.6	0.46	82	11.9	68.8	893	37.7	75.7	0.50	90	13.0	71.0	860	31.9	63.7	0.48	67	10.8	70.1	850	33.2	72.5	0.41	89	12.0	65.2	968
Seward	28.3	70.6	0.49	77	10.9	65.5	869	27.1	75.7	0.56	78	11.1	67.9	805	30.4	66.5	0.49	71	10.2	65.1	820	27.3	69.7	0.42	83	11.3	63.4	983
TAM 107	32.7	69.4	0.45	81	11.4	69.8	937	32.6	74.5	0.53	82	12.4	72.2	1010	35.2	65.1	0.44	78	10.5	70.1	865	30.3	68.5	0.39	83	11.4	67.2	935
Tandem	32.4	70.6	0.42	86	12.6	70.3	914	31.0	74.2	0.51	83	13.1	70.0	910	33.5	65.4	0.41	81	11.9	71.0	878	32.8	72.2	0.35	95	12.7	70.0	953
Vista	29.8	71.2	0.44	84	11.8	67.6	904	30.5	75.7	0.53	81	12.7	72.2	950	31.6	67.0	0.42	83	11.1	67.0	840	27.3	70.8	0.38	89	11.5	63.7	923
Nursery Mean								28.8	73.7	0.53	82	12.7	72.2	930	29.4	65.1	0.46	76	11.0	67.9	838	28.9	69.8	0.42	85	11.8	66.6	922
Nursery St. Dev.								2.7	1.5	0.03	4	0.6	1.7	56	1.9	1.7	0.04	5	0.6	2.3	39	2.2	2.0	0.03	4	0.6	20.0	41
Nursery C.V. %								9.3	2.0	5.64	5	4.6	2.3	6	6.6	2.6	0.46	7	5.7	3.4	5	7.7	2.8	7.43	5	4.8	3.0	4
Subset Mean	29.8	70.4	0.46	83	11.8	68.6	899	29.5	74.9	0.54	82	12.6	70.9	909	30.5	66.2	0.45	79	11.1	68.5	853	29.6	70.3	0.40	87	11.8	66.4	936
Subset LSD (.05)	2.7	1.8	0.02	7	0.5	2.1	61																					
Subset C.V. %	6.4	1.8	3.50	6	2.7	2.1	5																					

KW = Single kernel weight (mg); FY = Flour yield (percent of total product); ASH = Flour ash (percent at 14 % moisture basis); MS = Milling Score (100 point scale); PRO = Flour protein (percent at 14.0 % moisture basis); ABS = Bake absorption (14 % moisture basis); LV = Loaf volume.

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY DIVISION - PLANT VARIETY PROTECTION OFFICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

The following statements are made in accordance with the Privacy Act 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protect certificate is to be issued (7 U.S.C. 2421). Information is held confiden until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S)

South Dakota Agricultural Experiment Station

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER

SD89153

3. VARIETY NAME

Crimson

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*

South Dakota State University
Ag Hall 129
Brookings, SD 57007

5. TELEPHONE *(include area code)*

605-688-4149

6. FAX *(include area code)*

605-688-6065

7. PVPO NUMBER

9800368

8. Does the applicant own all rights to the variety? *Mark an "X" in appropriate block.* If no, please explain. [X] YES [ ] NO

9. Is the applicant (individual or company) a U.S. national or U.S. based company? [X] YES [ ] NO
If no, give name of country _____

10. Is the applicant the original breeder? If no, please answer the following: [X] YES [ ] NO

a. If original rights to variety were owned by individual(s):
Is (are) the original breeder(s) a U.S. national(s)? If no, give name of country _____

b. If original rights to variety were owned by a company: [ ] YES [ ] NO
Is the original breeder(s) U.S. based company? If no, give name of country _____

11. Additional explantion on ownership *(If needed, use reverse for extra space):*

PLEASE NOTE:

Plant variety protection can be afforded only to owners (not licensees) who meet one of the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original breeder, both the original breeder and the applicant must meet one of the above criteria.

The original breeder may be the individual or company who directed final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definition.